



Figure 3 The cytoskeleton, made of protein fibers, helps a cell retain its shape, move in its environment, and move its organelles.

Cytoskeleton

The *cytoskeleton* (sīĕt oh SKEL uh tuhn) is a web of proteins in the cytoplasm. The cytoskeleton, shown in **Figure 3**, acts as both a muscle and a skeleton. It keeps the cell's membranes from collapsing. The cytoskeleton also helps some cells move.

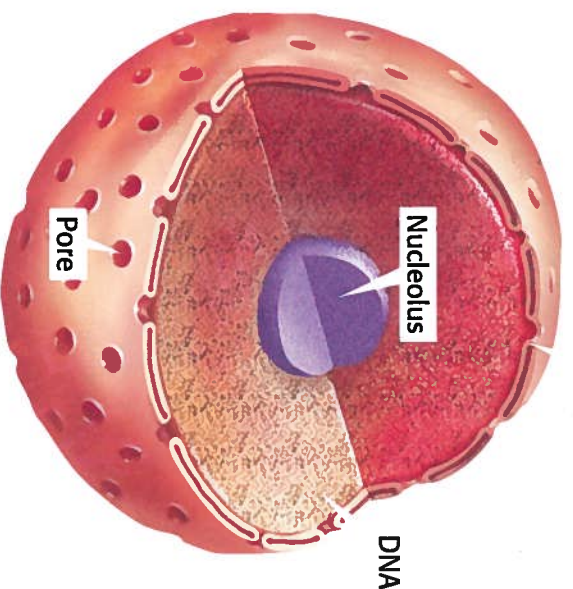
The cytoskeleton is made of three types of protein. One protein is a hollow tube. The other two are long, stringy fibers. One of the stringy proteins is also found in muscle cells.

Reading Check What is the cytoskeleton?

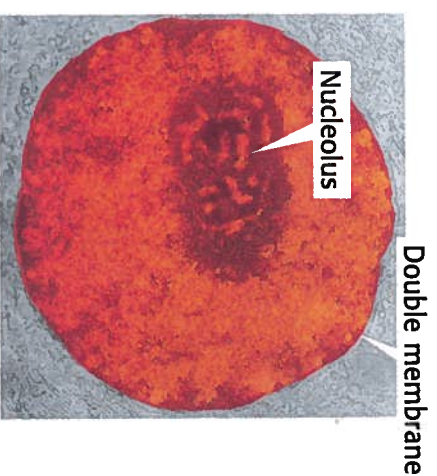
Nucleus

All eukaryotic cells have the same basic membrane-bound organelles, starting with the nucleus. The *nucleus* is a large organelle in a eukaryotic cell. It contains the cell's DNA, or genetic material. DNA contains the information on how to make a cell's proteins. Proteins control the chemical reactions in a cell. They also provide structural support for cells and tissues. But proteins are not made in the nucleus. Messages for how to make proteins are copied from the DNA. These messages are then sent out of the nucleus through the membranes.

The nucleus is covered by two membranes. Materials cross this double membrane by passing through pores. **Figure 4** shows a nucleus and nuclear pores. The nucleus of many cells has a dark area called the nucleolus (noo KLEE uh luhs). The *nucleolus* is where a cell begins to make its ribosomes.



Double membrane



Ribosomes

Organelles that make proteins are called **ribosomes**. Ribosomes are the smallest of all organelles. And there are more ribosomes in a cell than there are any other organelles. Some ribosomes float freely in the cytoplasm. Others are attached to membranes or the cytoskeleton. Unlike most organelles, ribosomes are not covered by a membrane.

Proteins are made within the ribosomes. Proteins are made of amino acids. An *amino acid* is any one of about 20 different organic molecules that are used to make proteins. All cells need proteins to live. All cells have ribosomes.

Endoplasmic Reticulum

Many chemical reactions take place in a cell. Many of these reactions happen on or in the endoplasmic reticulum (EN doh PLAZ mik it TIK yuh luhn). The **endoplasmic reticulum**, or ER, is a system of folded membranes in which proteins, lipids, and other materials are made. The ER is shown in **Figure 5**. The ER is part of the internal delivery system of the cell. Its folded membrane contains many tubes and passageways. Substances move through the ER to different places in the cell.

Endoplasmic reticulum is either rough ER or smooth ER. The part of the ER covered in ribosomes is rough ER. Rough ER is usually found near the nucleus. Ribosomes on rough ER make many of the cell's proteins. The ER delivers these proteins throughout the cell. ER that lacks ribosomes is smooth ER. The functions of smooth ER include making lipids and breaking down toxic materials that could damage the cell.

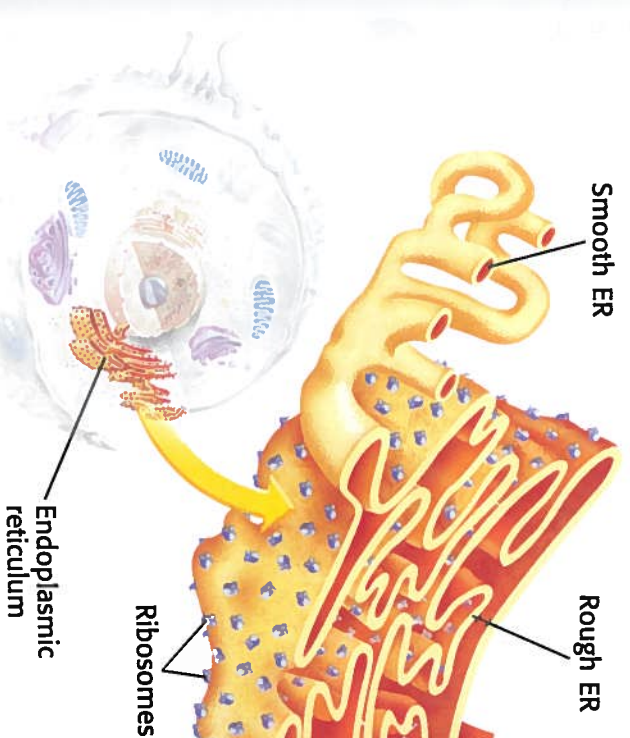


Figure 5 The endoplasmic reticulum (ER) is a system of membranes. Rough ER is covered with ribosomes. Smooth ER does not have ribosomes.

ribosome cell organelle composed of RNA and protein; the site of protein synthesis

endoplasmic reticulum a system of membranes that is found in a cell's cytoplasm and that assists in the production, processing, and transport of proteins and in the production of lipids